

What is Claimed Is:

- 1 1. An apparatus for determining the presence of a trace species
2 in a sample gas contained in a resonant cavity, the apparatus comprising:
3 at least one light source for generating radiation;
4 a controller coupled to the at least one light source for controlling a
5 frequency of the radiation, the controller varying the frequency of the radiation
6 over a predetermined frequency range; and
7 a processor coupled to the resonant cavity for determining a level
8 of absorption within the resonant cavity over the predetermined frequency
9 range.
- 1 2. The apparatus according to claim 1, wherein the controller
2 varies the frequency of the at least one light source over a predetermined time
3 period.
- 1 3. The apparatus according to claim 2, wherein the frequency is
2 varied at a substantially constant rate over the predetermined time period.
- 3 4. The apparatus according to claim 2, wherein a profile of the
4 frequency is one of a sawtooth wave pattern and a triangle pattern.
- 1 5. The apparatus according to claim 2, wherein a profile of the
2 frequency has a leading edge slope and a trailing edge slope that are
3 substantially identical.
- 4 6. The apparatus according to claim 1, wherein the controller
5 varies the frequency of the at least one light source based on a temperature of
6 the at least one light source.
- 1 7. The apparatus according to claim 6, wherein the frequency is
2 varied at a substantially constant rate over the predetermined time period.
- 1 8. The apparatus according to claim 6, wherein an initial
2 temperature is about 0 degrees Centigrade.

1 9. The apparatus according to claim 6, wherein a profile of the
2 temperature is one of a sawtooth wave pattern and a triangle pattern.

1 10. The apparatus according to claim 6, wherein a profile of the
2 temperature has a leading edge slope and a trailing edge slope that are
3 substantially identical.

1 11. The apparatus according to claim 6, wherein the frequency of
2 the radiation is proportional to the temperature.

1 12. The apparatus according to claim 6, wherein the temperature
2 is repeatedly swept over a predetermined range.

1 13. The apparatus according to claim 1, wherein the controller
2 controls a current supplied to the at least one light source.

1 14. The apparatus according to claim 13, wherein the controller
2 varies the frequency of the at least one light source over a predetermined time
3 period based on the current.

1 15. The apparatus according to claim 14, wherein the current is
2 varied at a substantially constant rate over the predetermined time period.

1 16. The apparatus according to claim 13, wherein a profile of the
2 current is one of a sawtooth wave pattern and a triangle pattern.

1 17. The apparatus according to claim 13, wherein a profile of the
2 current has a leading edge slope and a trailing edge slope that are substantially
3 identical.

1 18. The apparatus according to claim 1, wherein the processor
2 determines an absorption spectrum of the sample gas based on a ring-down rate
3 of the radiation within the resonant cavity.

1 19. The apparatus according to claim 1, wherein the level of the
2 trace species is a plurality of levels taken at respective frequencies of the light
3 source.

1 20. The apparatus according to claim 1, wherein the at least one
2 light source is a plurality of light sources, each generating a respective radiation
3 output.

4 21. The apparatus according to claim 1, further comprising a
5 coupler for coupling the radiation into an input of the resonant cavity.

1 22. The apparatus according to claim 1, wherein the controller
2 controls both a temperature of the at least one light source and a current
3 supplied to the at least one light source.

1 23. A system for determining the presence of a trace species in a
2 sample gas, the system comprising:

3 a resonant cavity containing at least a portion of the sample gas;

4 at least one light source for generating radiation;

5 a coupler for coupling the radiation into the resonant cavity;

6 a controller coupled to the at least one light source for controlling a
7 frequency of the radiation based on at least one of a temperature of the light
8 source and a current supplied to the light source, the controller varying the
9 temperature and/or the current of the light source over a predetermined range;
10 and

11 a processor coupled to the resonant cavity for determining a level
12 of the trace species within the resonant cavity over the frequency.

1 24. The system according to claim 23, wherein at least one of
2 the temperature and the current are varied at a substantially constant rate over
3 a predetermined time period.

1 25. The system according to claim 23, wherein the processor
2 determines an absorption spectrum of the sample gas based on a ring-down rate
3 of the radiation within the resonant cavity.

1 26. A method for determining the presence of a trace species in
2 a sample gas contained in a resonant cavity, the method comprising the steps
3 of:

- 4 a) generating radiation from at least one light source;
5 b) coupling the radiation into an input of the resonant cavity;
6 c) controlling a frequency of the radiation of the at least one light
7 source;
8 d) varying the frequency of the radiation over a predetermined
9 frequency range; and
10 e) determining a level of the trace species within the resonant
11 cavity over the predetermined frequency range.

1 27. The method according to claim 26, further comprising the
2 step of:

3 repeatedly varying the frequency of the light source over the
4 predetermined frequency range.

1 28. The method according to claim 26, wherein the controlling
2 step c) further comprises at least one of the steps of:

- 3 controlling a temperature of the light source; and
4 controlling a current provided to the light source.

1 29. An apparatus for determining the presence of a trace species
2 in a sample gas contained in a resonant cavity comprising:

- 3 means for generating radiation from at least one light source;
4 means for coupling the radiation into an input of the resonant
5 cavity;
6 means for controlling a frequency of the radiation of the at least
7 one light source;

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- 8 means for varying the frequency of the radiation over a
9 predetermined frequency range; and
- 10 means for determining a level of the trace species within the
11 resonant cavity over the predetermined frequency range.